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Uchino et al.

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(54) **SHEET CONVEYING DEVICE AND IMAGE RECORDING APPARATUS COMPRISING SHEET CONVEYING DEVICE**

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B65H 3/52 (2006.01)

(52) **U.S. Cl.** **271/121**; 271/123; 271/186; 271/225; 271/253; 271/902; 271/3.08

(58) **Field of Classification Search** ..... None
See application file for complete search history.

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Primary Examiner—Stefanos Karmis
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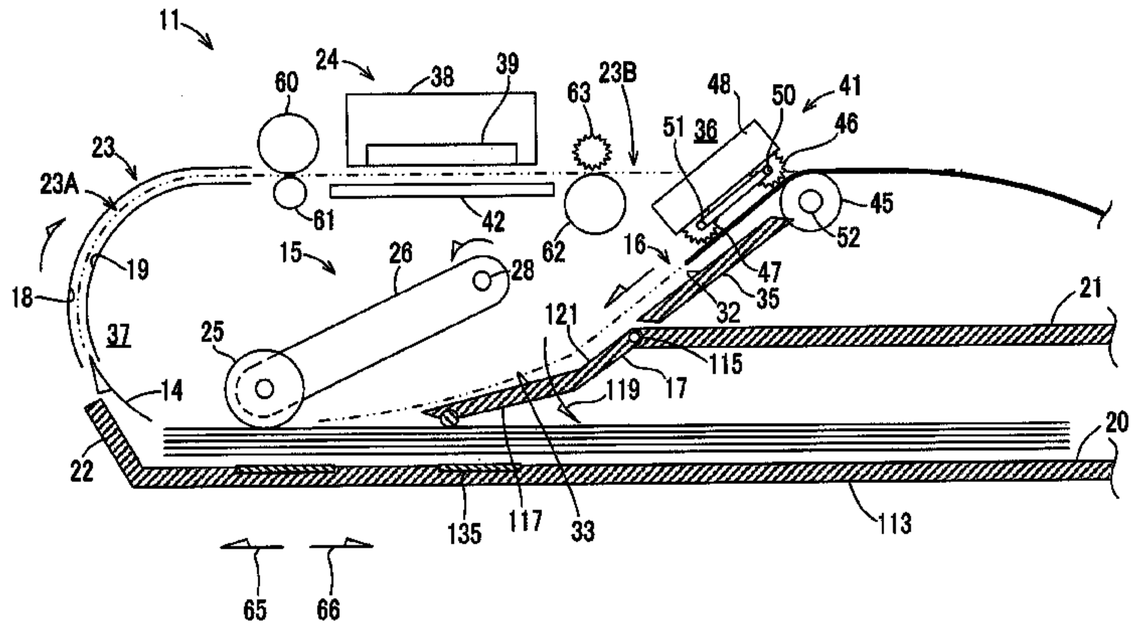
(57) **ABSTRACT**

A sheet conveying device includes a feed tray including a bottom plate configured to hold a sheet, a feed roller configured to feed the sheet in a first direction from the feed tray to a first conveying path, and a pressing member configured to press the sheet in the feed tray against the bottom plate of the feed tray. The pressing member includes a contact portion configured to contact the sheet in the feed tray, and a first guide positioned at a downstream end of the pressing member in the first direction. The first guide extends between the downstream end and the contact portion obliquely with respect to the bottom plate, such that a distance between the bottom plate and the first guide increases along the first direction. The first guide is positioned upstream of the feed roller in the first direction.

12 Claims, 11 Drawing Sheets



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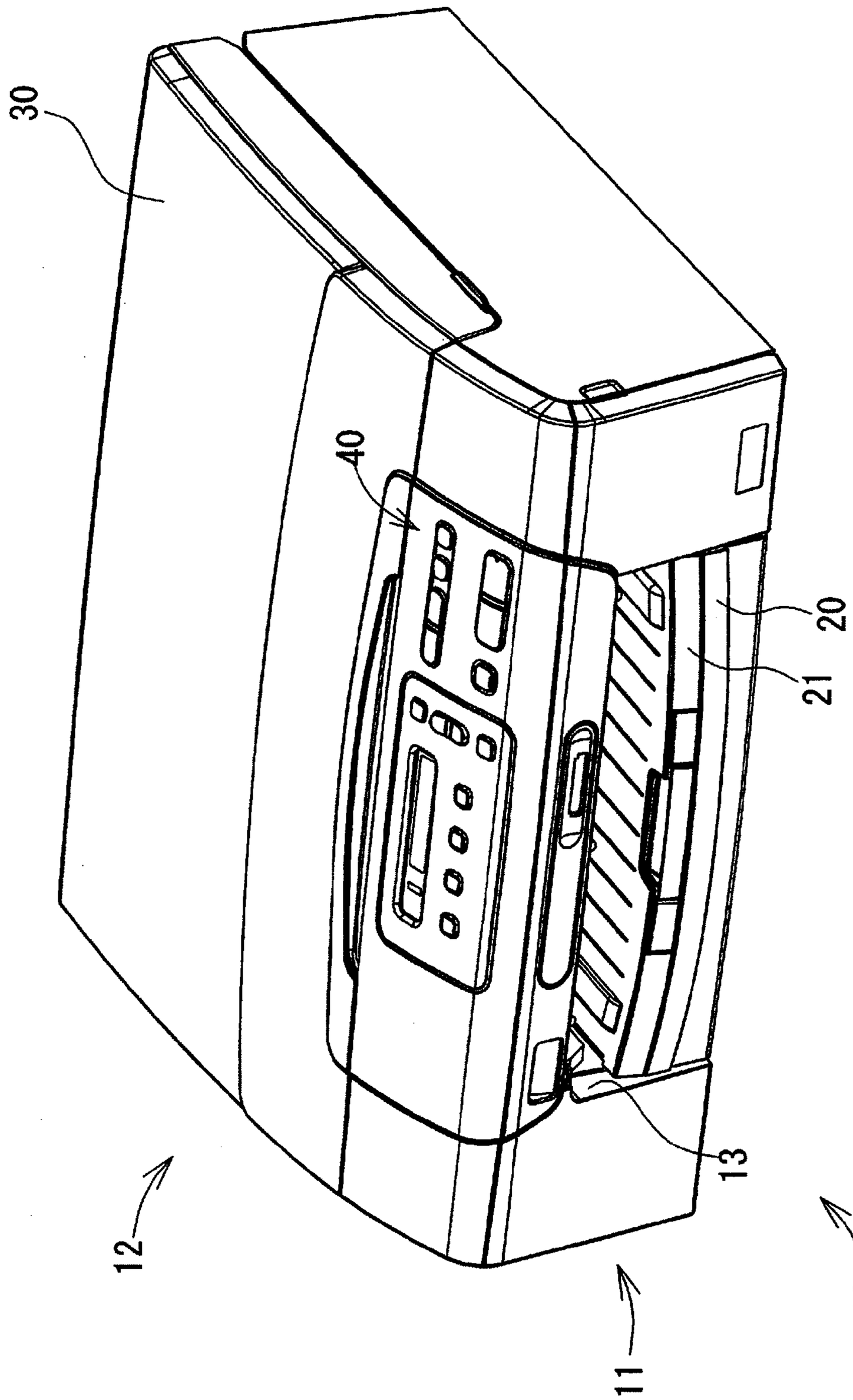

Fig.1

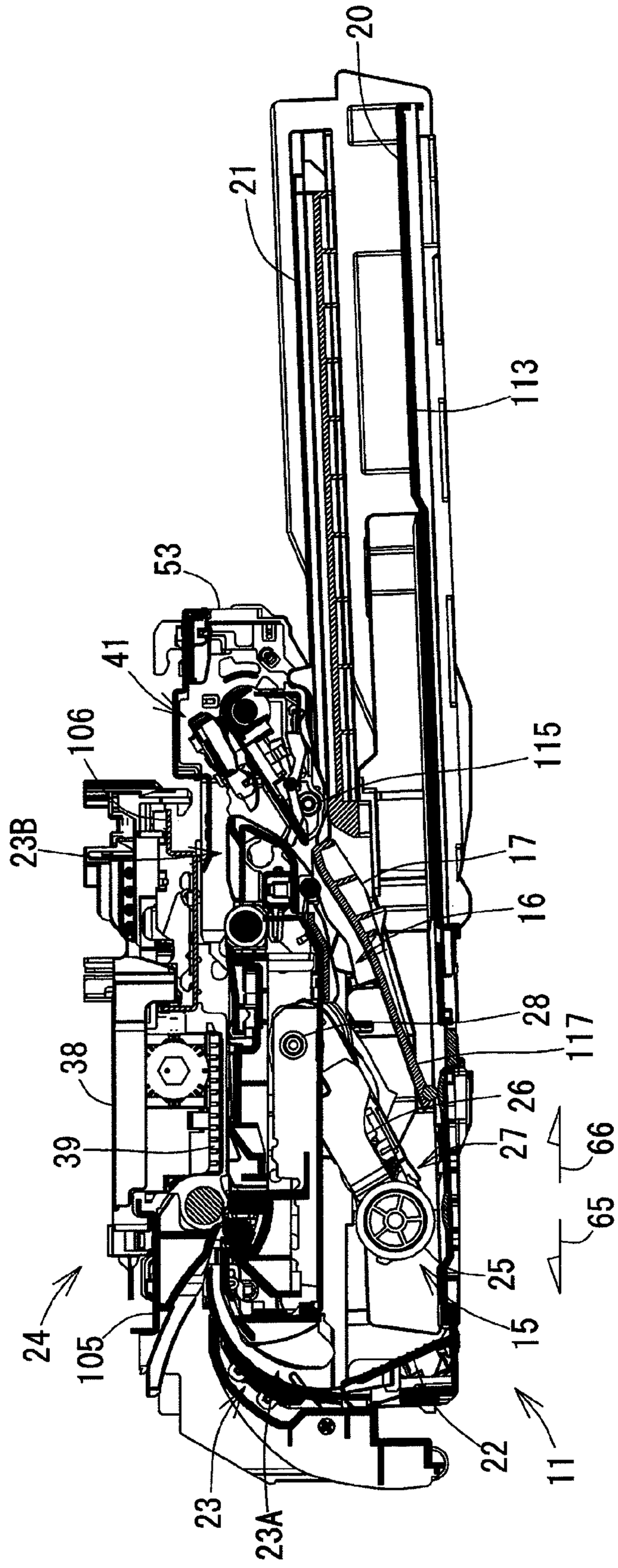
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Fig.2

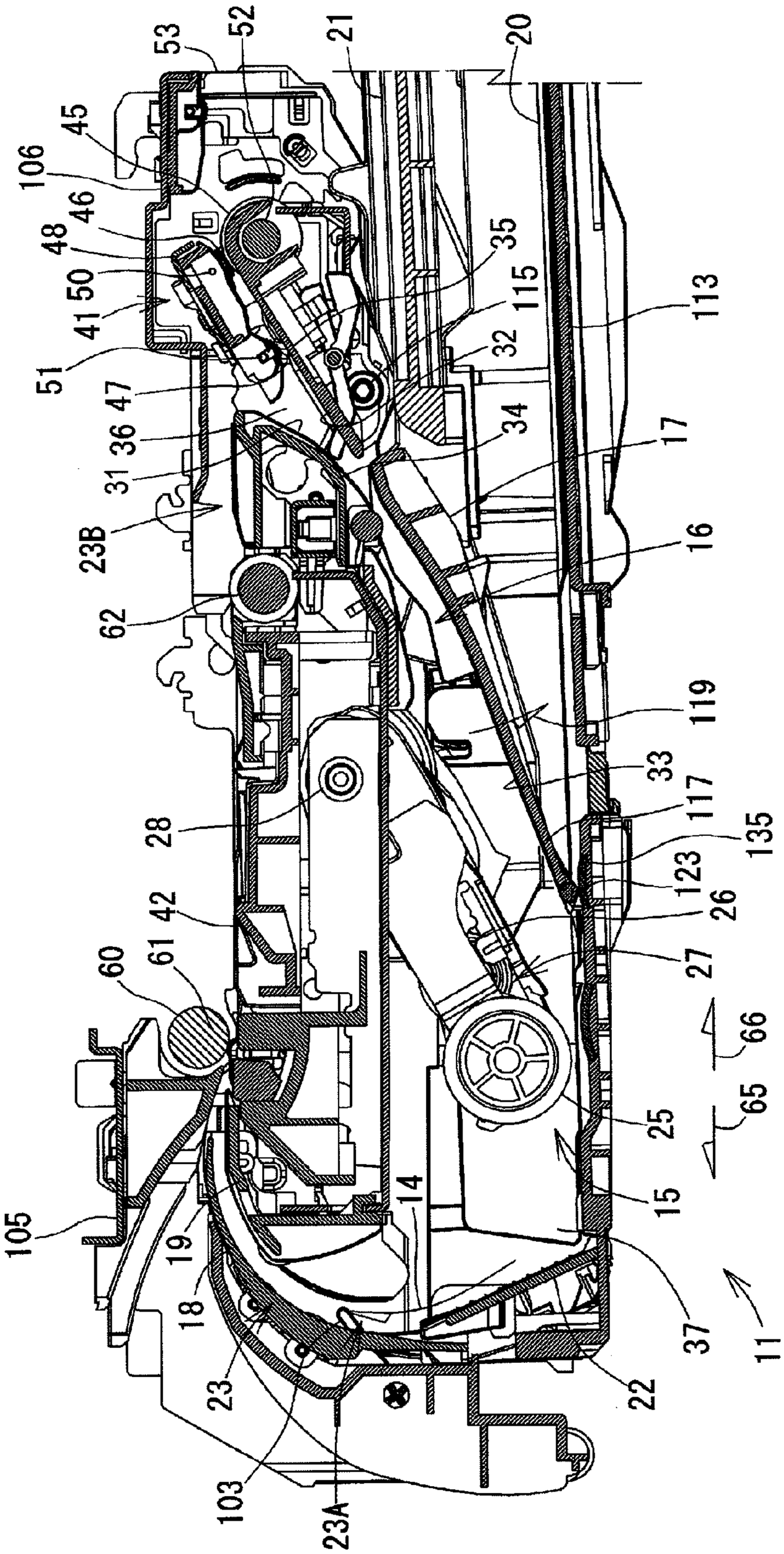
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Fig.3

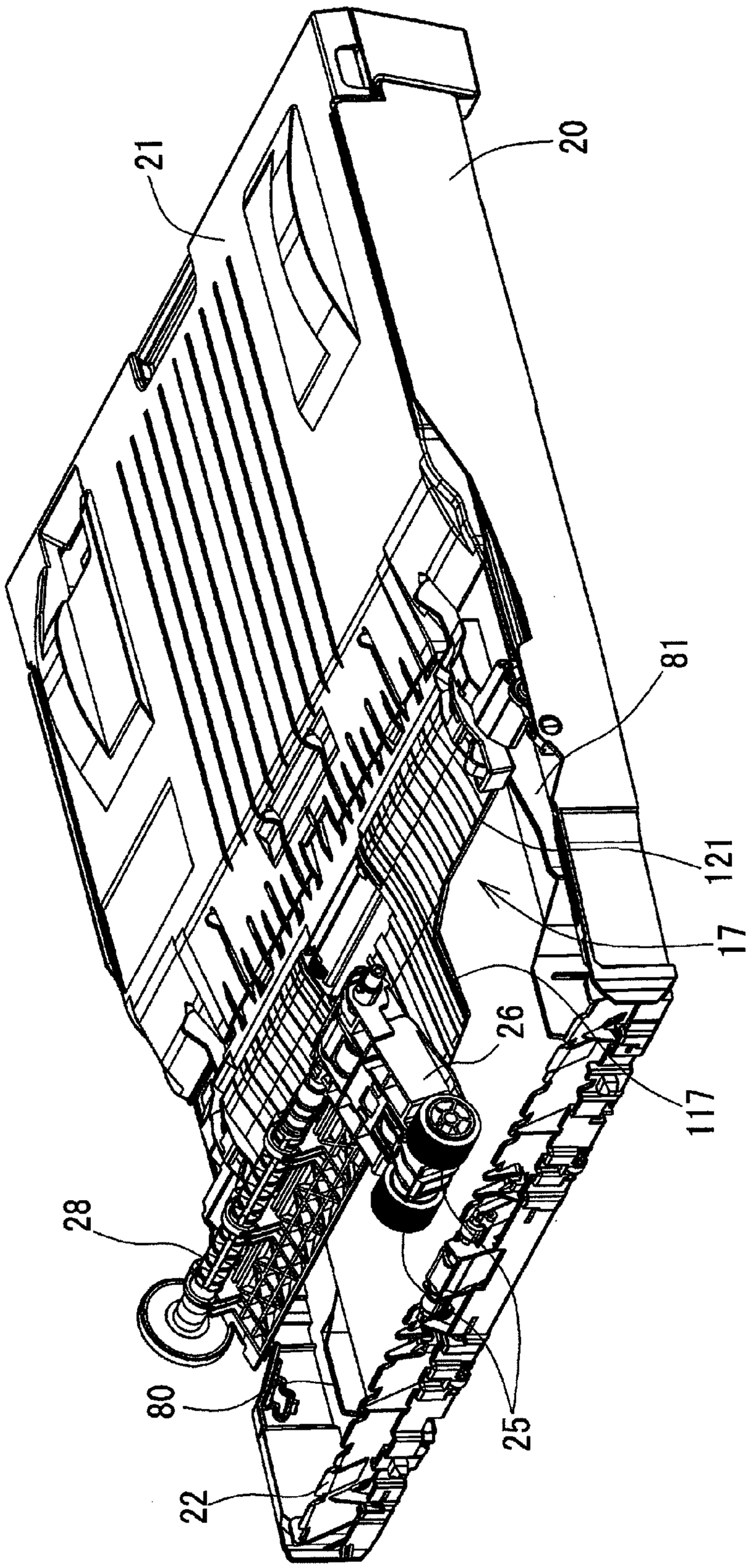

Fig.4

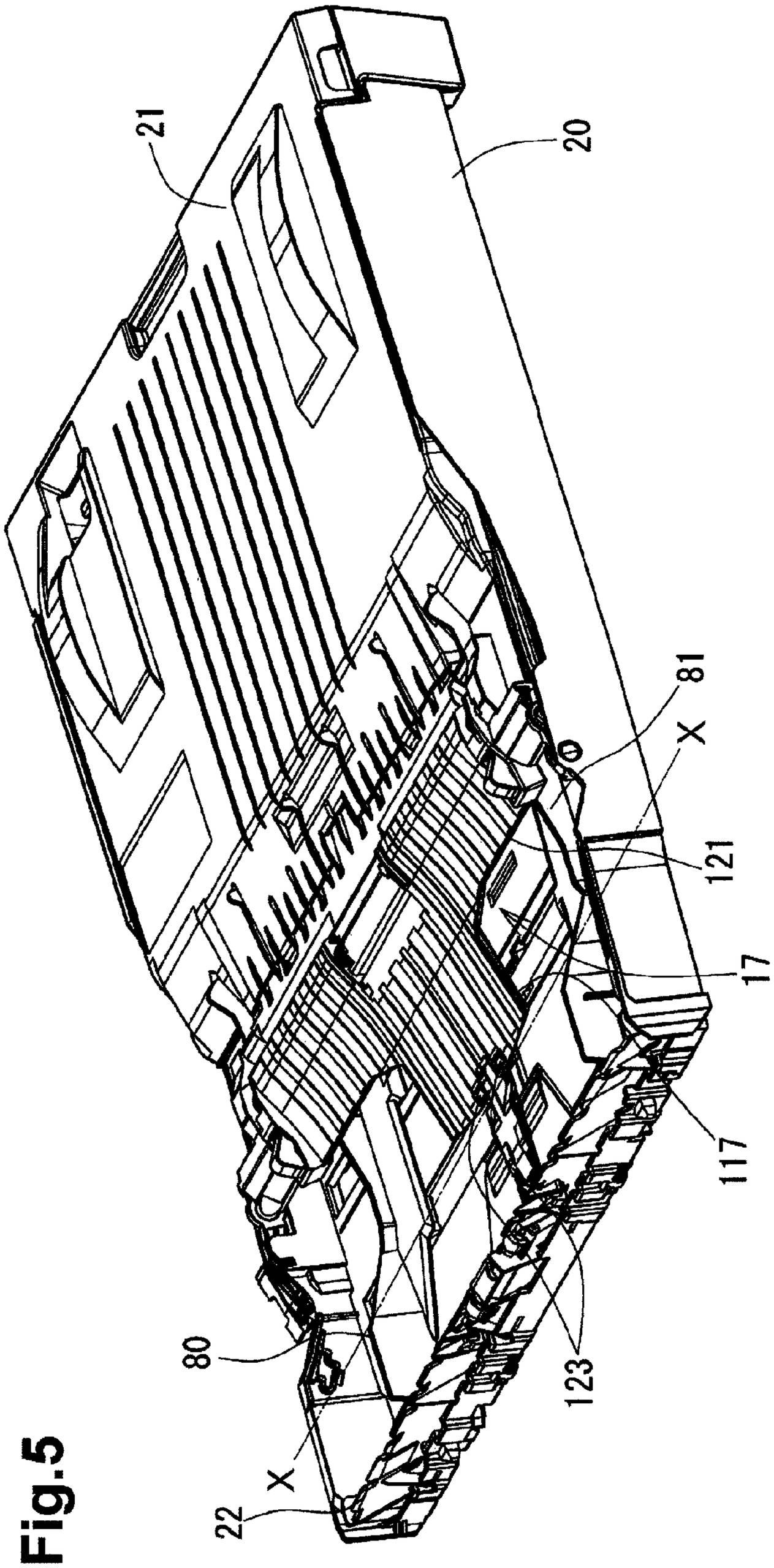

Fig.5

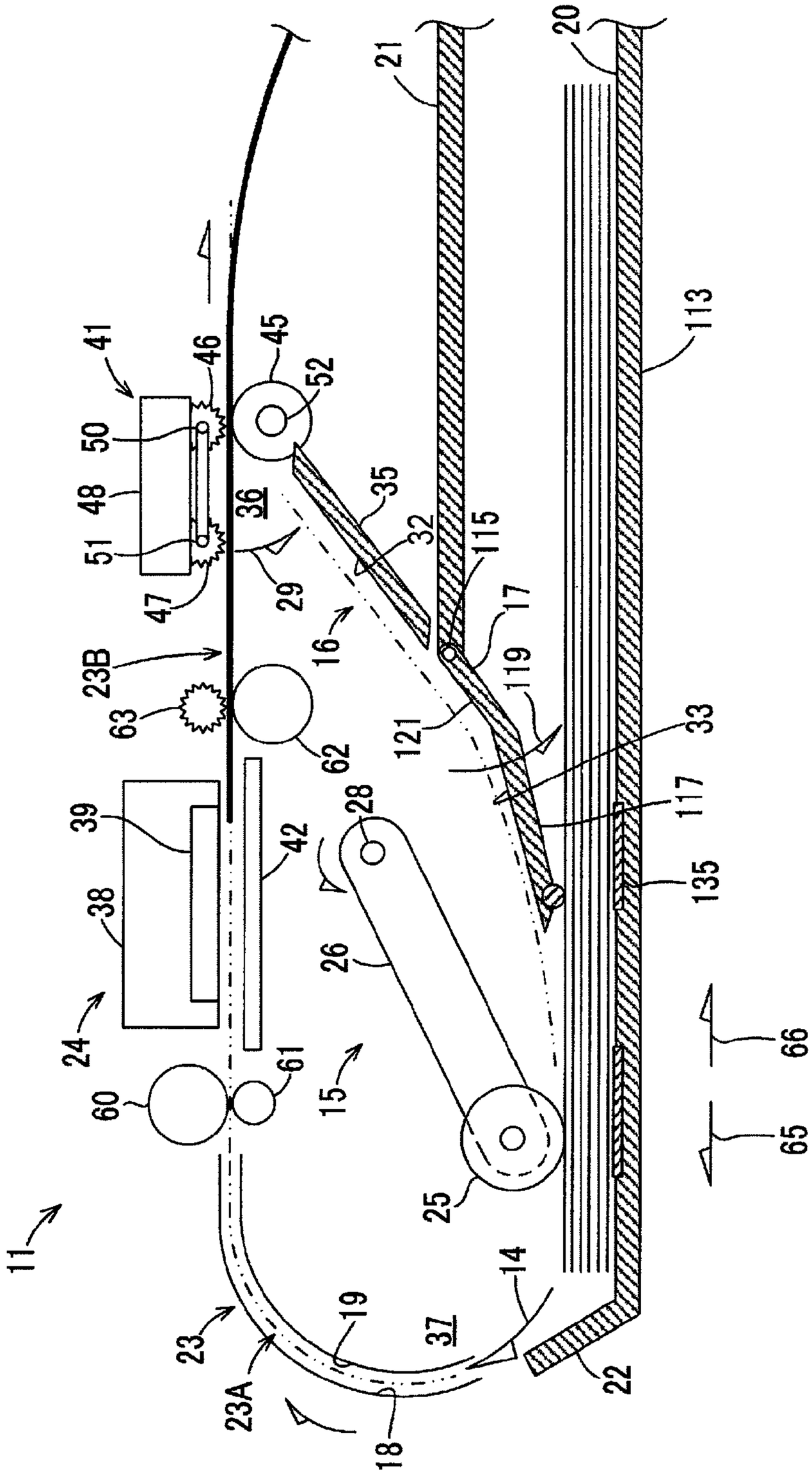
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Fig.6

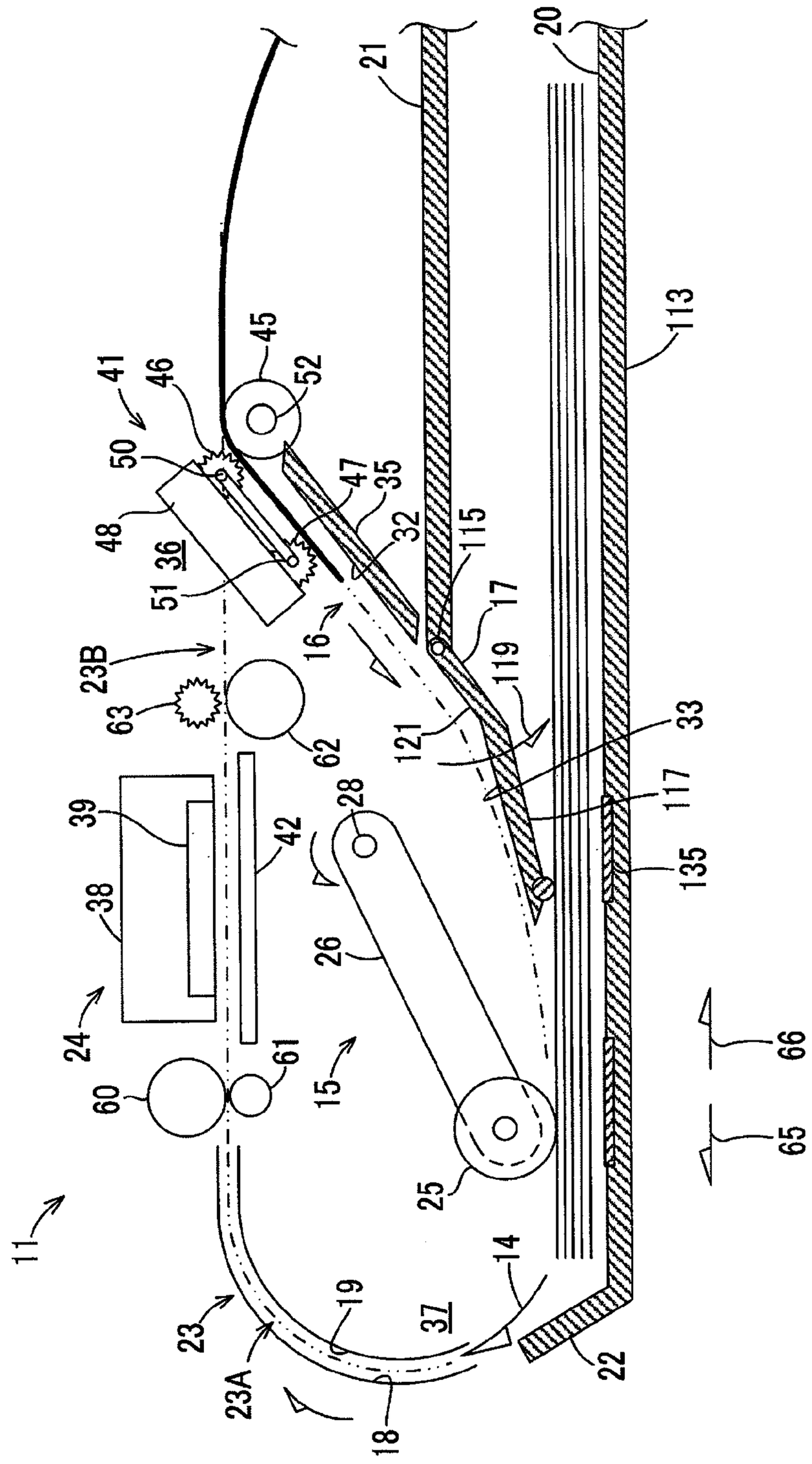
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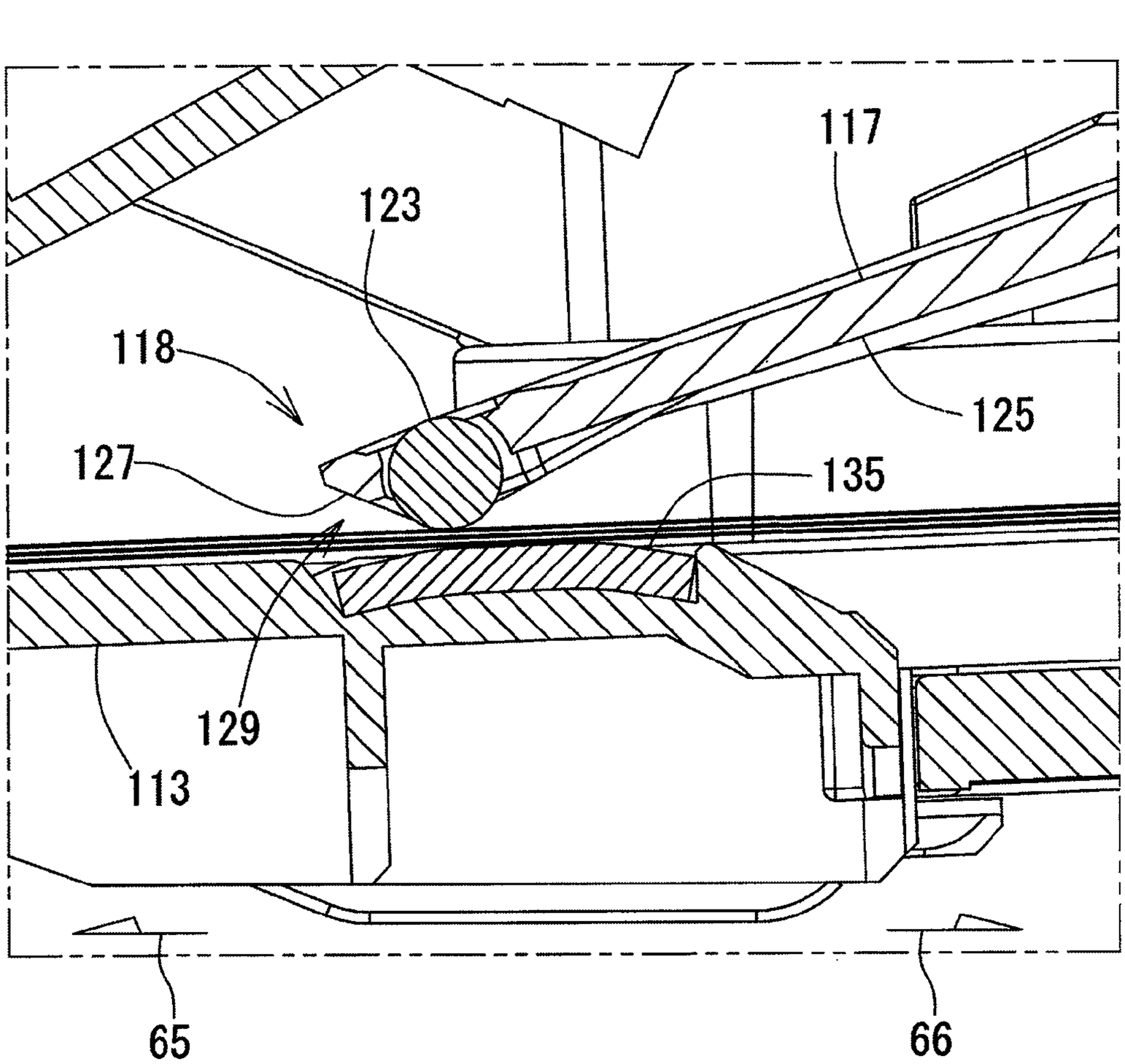
Fig.7

Fig.8



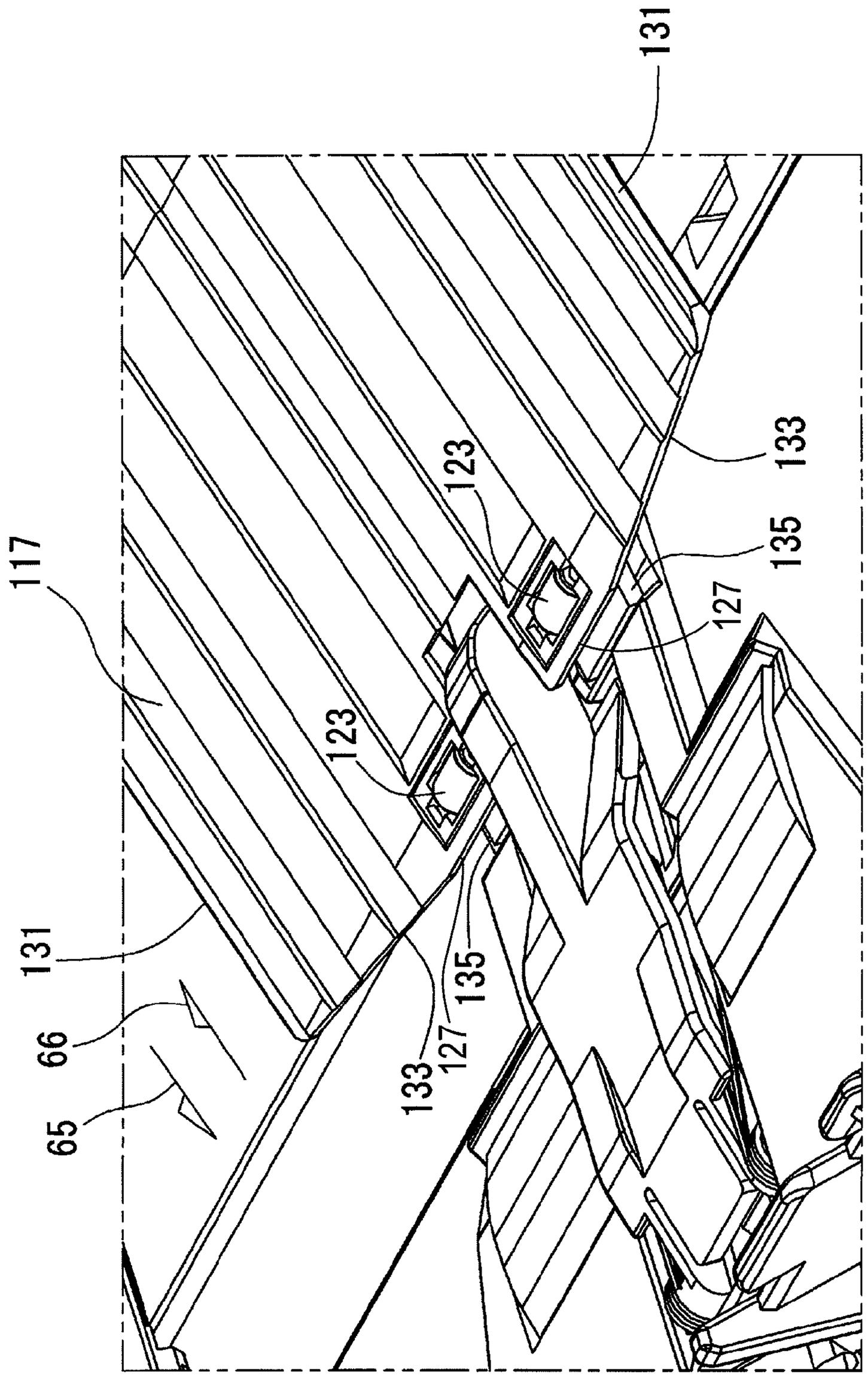


Fig.9

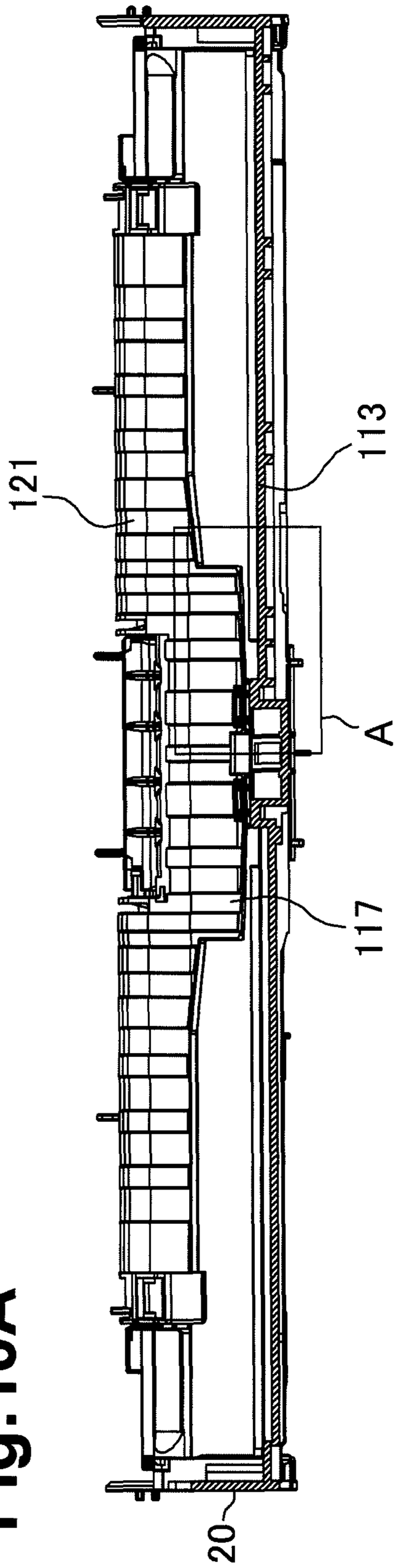


Fig.10A

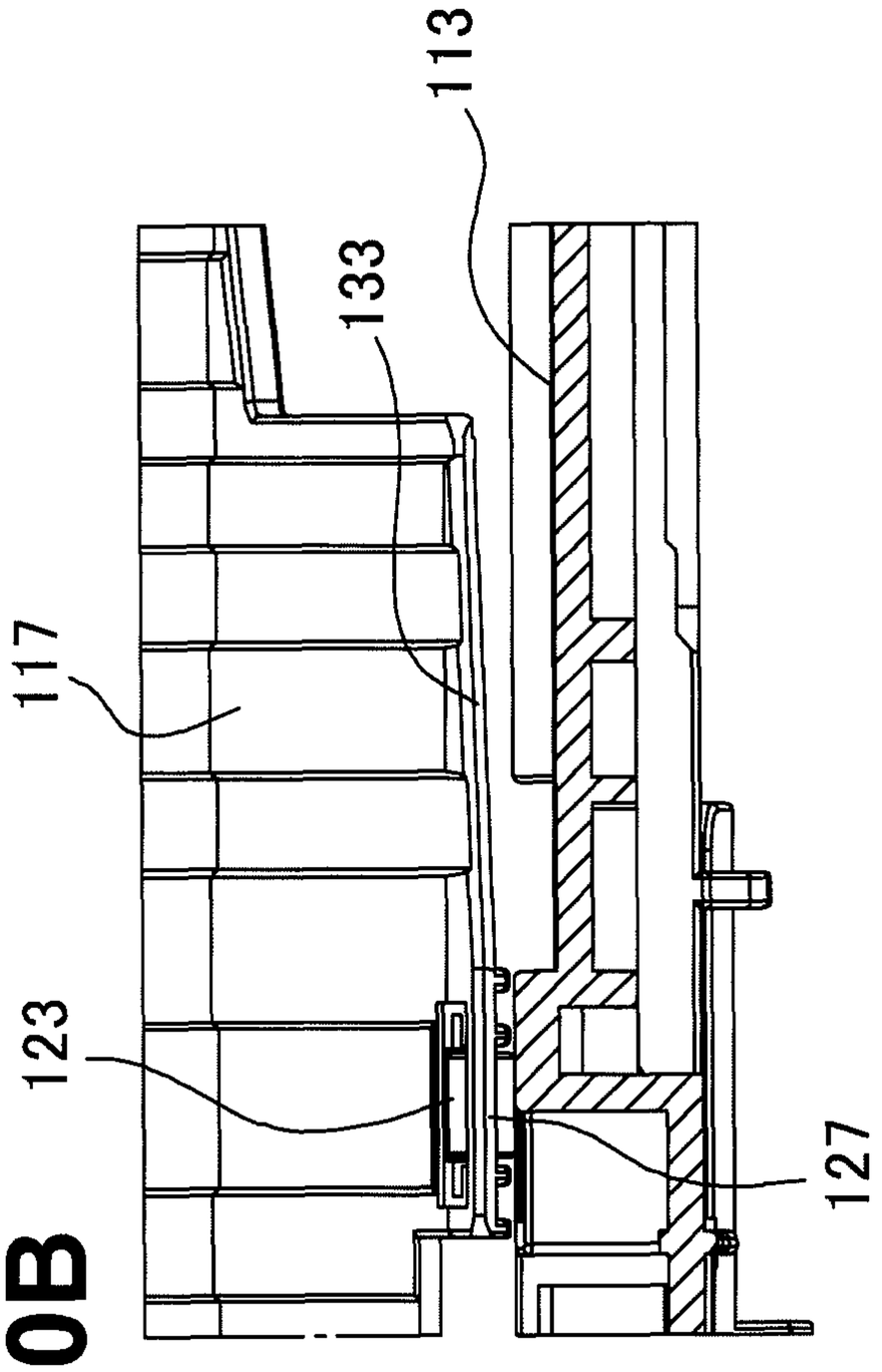


Fig.10B

Fig.11A

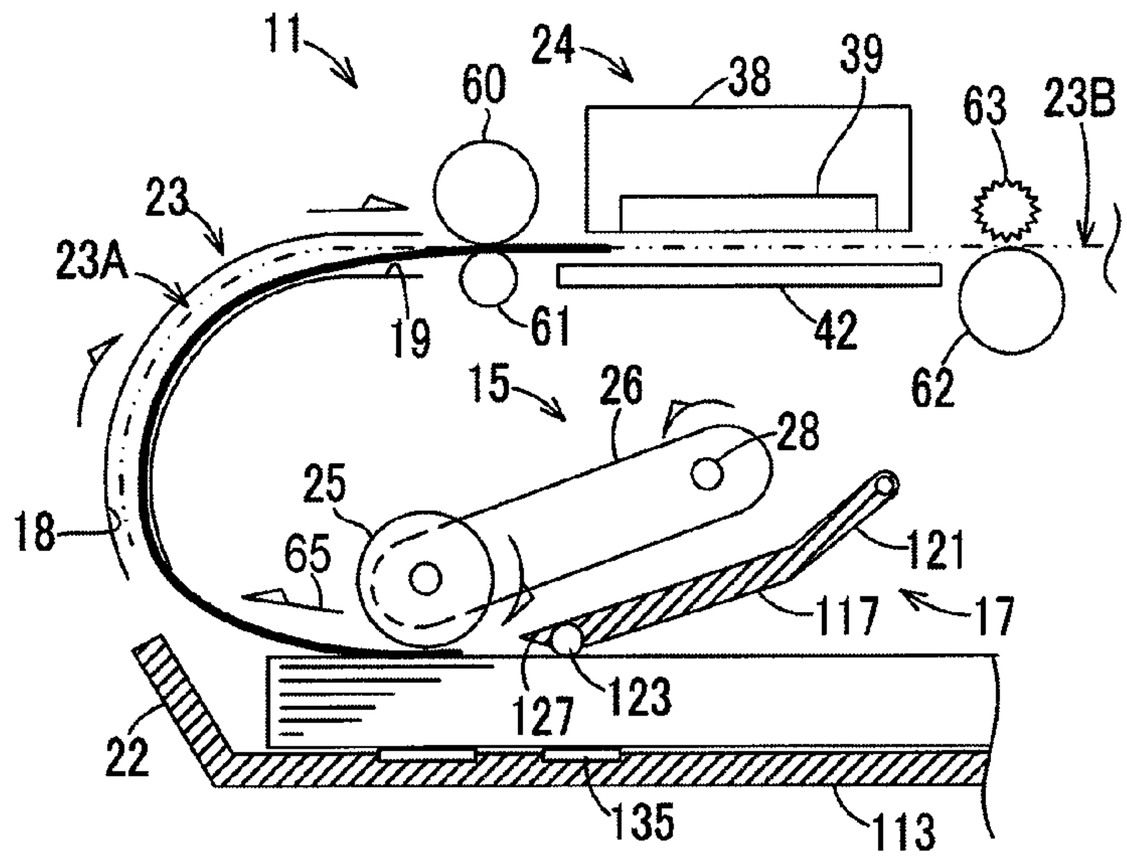


Fig.11B

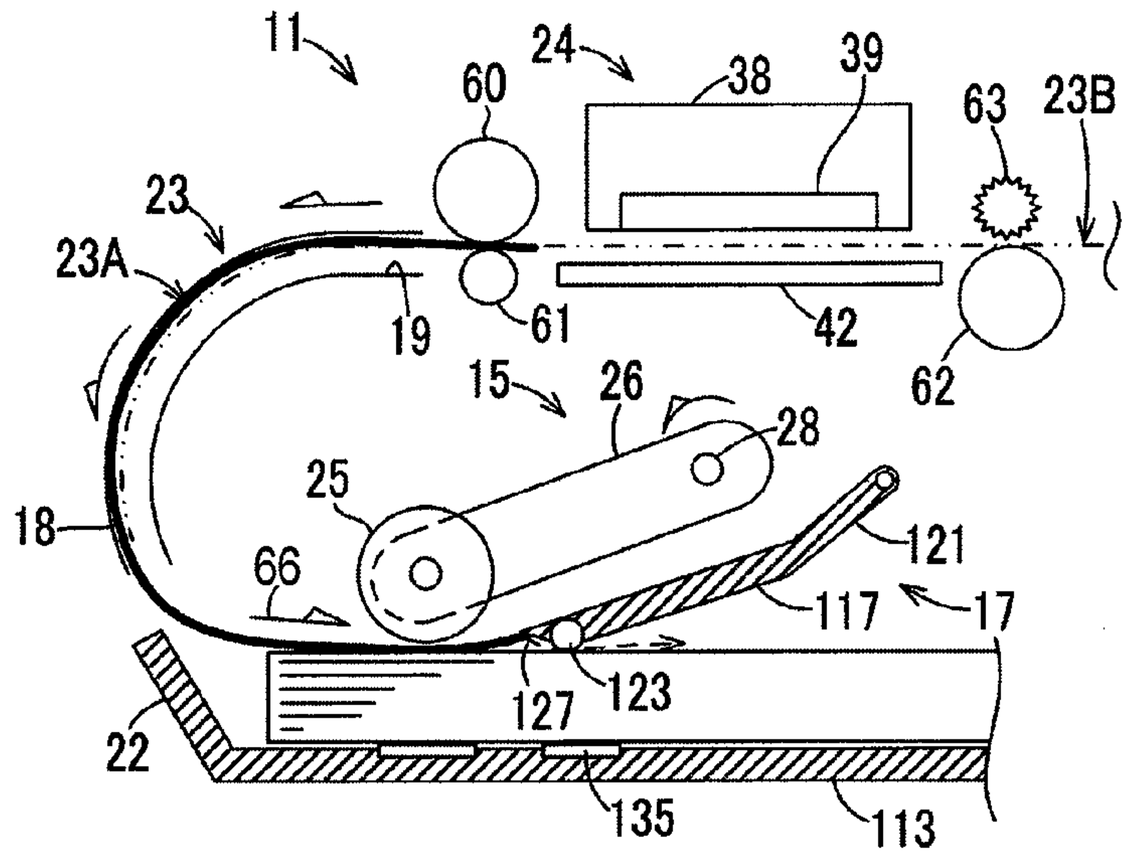


Fig.11C

SHEET CONVEYING DEVICE AND IMAGE RECORDING APPARATUS COMPRISING SHEET CONVEYING DEVICE

CROSS REFERENCE TO RELATED APPLICATION

This application claims priority from Japanese Patent Application No. 2008-251121, which was filed on Sep. 29, 2007, the disclosure of which is incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This application relates to a sheet conveying device that feeds a recording medium, e.g., a sheet, along a conveying path while reducing the occurrence of skewing of the sheet, and relates to an image recording apparatus comprising such a sheet conveying device.

2. Description of Related Art

A known sheet conveying device comprises a feed roller, a feed tray, and a pressing member. The feed roller feeds an uppermost one of sheets from the feed tray while the pressing member presses the uppermost sheet in the tray. This may prevent skewing of the sheet being fed.

A known sheet conveying device used for an image recording apparatus employs a so-called reverse registration in order to correct skewing of a sheet before recording an image on the sheet. The sheet fed by a feed roller from a feed tray and reaching the pair of convey rollers is conveyed back to the feed tray by a predetermined distance in order to align a leading edge of the sheet with respect to the pair of convey rollers.

When a sheet is conveyed back to a feed tray, for the purpose of such reverse registration or other reasons, in a sheet conveying device comprising a member for pressing a sheet in the feed tray, a trailing edge of the sheet conveyed back to the feed tray may collide with the pressing member, resulting in skewing or jamming of the sheet.

SUMMARY OF THE INVENTION

Therefore, a need has arisen for a sheet conveying device and an image recording apparatus that overcome these and other shortcomings of the related art.

According to an embodiment of the invention, a sheet conveying device comprises a feed tray comprising a bottom plate configured to hold a sheet, a feed roller configured to feed the sheet in a first direction from the feed tray to a first conveying path, and a pressing member configured to press the sheet in the feed tray against the bottom plate of the feed tray. The pressing member comprises a contact portion configured to contact the sheet in the feed tray, and a first guide positioned at a downstream end of the pressing member in the first direction. The first guide extends between the downstream end and the contact portion obliquely with respect to the bottom plate, such that a distance between the bottom plate and the first guide increases along the first direction. The first guide is positioned upstream of the feed roller in the first direction.

According to another embodiment of the invention, an image recording apparatus comprises a sheet conveying device comprising a sheet conveying device and a recording unit. The sheet conveying device comprises a feed tray comprising a bottom plate configured to hold a sheet, a feed roller configured to feed the sheet in a first direction from the feed tray to a first conveying path, and a pressing member configured to press the sheet in the feed tray against the bottom plate of the feed tray. The pressing member comprises a contact portion configured to contact the sheet in the feed tray, and a first guide positioned at a downstream end of the pressing member in the first direction. The first guide extends between the downstream end and the contact portion obliquely with respect to the bottom plate, such that a distance between the bottom plate and the first guide increases along the first direction. The first guide is positioned upstream of the feed roller in the first direction. The recording unit is disposed along the first conveying path and configured to record an image onto the sheet being conveyed along the first conveying path.

Other objects, features, and advantages will be apparent to persons of ordinary skill in the art from the following detailed description of the invention and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the invention, the needs satisfied thereby, and the features and technical advantages thereof, reference now is made to the following descriptions taken in connection with the accompanying drawings.

FIG. **1** is a perspective view of an image recording apparatus, e.g., a multi-function device, according to an embodiment of the invention.

FIG. **2** is a vertical cross-sectional view of a printer according to an embodiment of the invention.

FIG. **3** is a partial enlarged vertical cross-sectional view of the printer of FIG. **2**.

FIG. **4** is a perspective view of a feed tray in which sheets are stacked.

FIG. **5** is a perspective view of the feed tray of FIG. **4** in which no sheets are stacked.

FIG. **6** is a schematic view illustrating the structure and operation of a path switching unit according to an embodiment of the invention.

FIG. **7** is a schematic view illustrating the structure and operation of the path switching unit of FIG. **6**.

FIG. **8** is an enlarged vertical cross-sectional view of a distal end of a flap according to an embodiment of the invention.

FIG. **9** is an enlarged perspective view of the distal end of the flap of FIG. **8**.

FIG. **10**A is a vertical cross-sectional view of the feed tray taken along line X-X of FIG. **5**, with side guides of the feed tray omitted from the view.

FIG. **10**B is an enlarged view of an enclosed portion A of FIG. **10**A.

FIGS. **11**A-**11**C are schematic views illustrating the printer of FIG. **2** in which a sheet is conveyed back to a feed tray, according to an embodiment of the invention.

DETAILED DESCRIPTION OF EMBODIMENTS

For a more complete understanding of the invention, the needs satisfied thereby, and the features and technical advantages thereof, reference now is made of the following descriptions taken in connection with the accompanying drawings.

As shown in FIG. **1**, an image recording apparatus, e.g., a multi-function device **10** may perform one or more functions, e.g., printing, coping, scanning, facsimile functions, or any combination thereof. The image recording apparatus may perform single-sided recording and/or double-sided recording.

The multi-function device **10** comprises a printer **11** disposed at the bottom, a scanner **12** disposed at the top, and an operation panel **40** disposed at the front top of the device **10**.

The printer **11** may record an image by inkjet method on a first side (front side) and a second side (back side) of a recording sheet. The printer **11** has an opening **13** at the front of the multi-function device **10**. A feed tray **20** and a discharge tray **21** are arranged in two layers vertically in the opening **13**. A recording medium, e.g., a sheet in the feed tray **20** is conveyed to the printer **11**, and the sheet having an image recorded thereon is discharged onto the discharge tray **21**. The feed tray **20** and the discharge tray **21** are detachably inserted into the printer **11** through the opening **13**.

The scanner **12** may be a flatbed scanner. A document cover **30** is disposed at the top of the scanner **12** and serves as a top plate of the multi-function device **10**. A platen glass (not shown) is disposed under the document cover **30**. The scanner **12** reads a document placed on the platen glass and covered by the document cover **30**.

The operation panel **40** for operating the printer **11** and the scanner **12** comprises operation buttons and a liquid crystal display. The operation panel **40** allows a user to perform various settings and operations, e.g., setting of the type of sheet (plain paper, postcard, etc.), the printing mode (single-sided mode or double-sided mode), and the resolution (draft mode or photo mode).

As shown in FIG. **2**, the printer **11** comprises the feed tray **20**, a sheet feeder **15**, a recording unit **24**, the discharge tray **21**, and a path switching unit **41**. The sheet fed by the sheet feeder **15** is conveyed along a first conveying path **23** to the recording unit **24**. The sheet having an image recorded thereon is discharged onto the discharge tray **21**. The path switching unit **41** is disposed between the recording unit **24** and the discharge tray **21** along the first conveying path **23**, and is configured to selectively direct having an image recorded thereon to the discharge tray along the first conveying path **23** or back to the feed tray **20** along a second conveying path, e.g., a reverse path **16**. The reverse path **16** is used for double-sided recording and is configured to guide the sheet toward the sheet feeder **15**, which feeds the sheet again to the first conveying path **23**.

The feed tray **20** is disposed under the sheet feeder **15** and at the bottom of the printer **11**. As shown in FIGS. **4** and **5**, the feed tray **20** is box-shaped and open upward, and comprises a bottom plate **113** for holding a stack of sheets. The sheet feeder **15** comprises a pair of feed rollers **25** configured to feed the sheets stacked on the feed tray **20** to the first conveying path **23**.

A pair of side guides **80**, **81** is disposed on the bottom plate **113**. The side guides **80**, **81** are made of a synthetic resin, e.g., an ABS resin, and has a substantially L-shaped horizontal section. The side guides **80**, **81** are configured to slide in a widthwise direction of the feed tray **20**, which is a direction perpendicular to the sheet plane of FIG. **3**.

The side guides **80**, **81** are configured to contact side edges of the sheets and to position the sheets in the feed tray **20** such that a widthwise center of the sheets coincides with a reference position, i.e., a widthwise center, of the feed tray **20**. In other words, the sheets are center-registered with respect to the reference position of the feed tray **20**. The sheets in the feed tray **20** are fed to a curved path **23**A in a first direction **65** while being guided by the side guides **80**, **81**.

The discharge tray **21** is disposed on the feed tray **20** and at a front side of the multi-function device **10**, i.e., a right side in FIG. **2**. The discharge tray **21** serves as a cover that covers the front side of the feed tray **20** and prevents intrusion of dust or the like.

As shown in FIG. **4**, a flap **17** is attached to one end, i.e., a left end in FIG. **2**, of the discharge tray **21**. The flap **17** is configured to contact and press the uppermost one of the sheets in the feed tray **20** and to suppress floating of the uppermost sheet which may curl due to moisture and temperature. The reverse path **16** comprises the flap **17** and guide members **34**, **35**.

The structure of the printer **11** is now described in detail. As shown in FIG. **3**, the sheet feeder **15** comprises the pair of feed rollers **25**, a feed arm **26**, and a drive transmission mechanism **27**. The feed rollers **25** are positioned at a substantially widthwise center of the feed tray **20** and are configured to feed the sheets in the feed tray **20** to the first conveying path **23**. The feed rollers **25** are supported rotatably at a distal end of the feed arm **26** and are rotated by a motor (not shown) via the transmission mechanism **27**, e.g., gears arranged substantially linearly.

A rotary encoder (not shown) is attached to the feed rollers **25**. The rotary encoder is configured such that an optical sensor detects a pattern of an encoder disc which rotates with the feed rollers **25**. Based on a signal output by the optical sensor, a controller (not shown) of the multi-function device **10** controls the rotation of the feed rollers **25**.

The feed arm **26** is supported, at its base end, on a shaft **28** so as to pivot about the shaft **28**. The feed arm **26** moves vertically toward and away from the feed tray. The feed arm **26** is biased by its own weight or by a spring, or by both, to pivot downward. Thus, the feed rollers **25** contact the bottom plate **113** of the feed tray **20** when there is no sheet in the feed tray **20**. The feed arm **26** is configured to move up away from the feed tray **20** when the feed tray **20** is inserted into and removed from the printer **11**.

In order to feed the sheets from the feed tray **20**, the feed rollers **25** rotate while pressing the sheets in the feed tray **20**. An uppermost one of the sheets is fed to the first conveying path **23** in the first direction **65** (leftward in FIG. **3**) due to friction generated between the feed roller **25** and the uppermost sheet.

When a leading edge of the uppermost sheet contacts a inclined separation plate **22** disposed on the feed tray **20**, the uppermost sheet is guided upward in a direction indicated by arrow **14** and fed into the first conveying path **23**. The inclined separation plate **22** prevents a sheet immediately under the uppermost sheet from being fed together due to friction and static electricity.

The first conveying path **23** comprises the curved path **23**A extending from the inclined separation plate **22** to the recording unit **24**, and a discharging path **23**B extending from the recording unit **24** to the discharge tray **21**. The curved path **23**A extends from the feed rollers **25** and along the inclined separation plate **22** upward, then curves in the U-shape toward the front of the multi-function device **10** (rightward in FIG. **3**), and reaches the recording unit **24**. The feed rollers **25** feed the uppermost sheet from the feed tray **20** while contacting one side of the uppermost sheet, and the uppermost sheet is conveyed along the first conveying path **23** such that the other side of the uppermost sheet faces the recording unit **24**. The discharging path **23**B extends substantially linearly from the rear side to the front side of the multi-function device **20** and reaches the discharge tray **21**.

The curved path **23** is defined, at the rear of the multi-function device **10**, by an outer guide member **18** and an inner guide member **19**. The outer guide member **18** and the inner guide member **19** are coupled to a main body frame **53** so as to oppose to each other with a predetermined interval left therebetween.

A convey roller **60** and a pinch roller **61** are disposed upstream of the recording unit **24** along the first conveying path **23**. The pinch roller **61** press-contacts the convey roller **60** from below. The convey roller **60** and the pinch roller nip the sheet conveyed along the curved path **23**A and conveys the sheet onto a platen **42**.

A discharge roller **62** and a spur **63** are disposed downstream of the recording unit **24** along the first conveying path **23**. The discharge roller **62** and the spur **63** nip the sheet having an image recorded thereon and conveyed the sheet further downstream toward the discharge tray **21**.

The convey roller **60** and the discharge roller **62** are driven by a motor (not shown) synchronously. The controller (not shown) causes the motor to rotate in forward and reverse directions. The convey roller **60** and the discharge roller **62** are driven intermittently during image recording such that an image is recorded on the sheet while the sheet is conveyed by a predetermined line feed width.

A rotary encoder (not shown) is attached to the convey roller **60**. The rotary encoder is configured such that an optical sensor detects a pattern of an encoder disc which rotates with the convey roller **60**. Based on a signal output by the optical sensor, the controller controls the rotation of the convey roller **60** and the discharge roller **62**. Before and after image recording, the convey roller **60** and the discharge roller **62** are driven continuously such that the sheet is conveyed at high speed.

A pivot member **103** is disposed upstream of the convey roller **60** on the curved path **23**A. The pivot member **103** projects from the outer guide **18** into the curved path **23**A so as to cross the curved path **23**A. When the sheet conveyed along the curved path **23**A contacts the pivot member **23**, the pivot member **23** pivots and blocks an optical path of a photo-interrupter (not shown). Based on a signal from the photo-interrupter, the controller detects the position of the sheet being conveyed.

One end of the reverse path **16** is connected to the discharging path **23**B and the other end thereof is connected to the feed tray **20**. More specifically, the reverse path **16** starts from a downstream portion **36** located downstream of the recording unit **24**, extends over the feed tray **20**, and reaches an upstream portion **37** located at an entrance of the curved path **23** A. The entrance is adjacent to the inclined separation plate **22**. The reverse path **16** guides the sheet having an image recorded on the front side (first side) thereof back to the feed tray **20**.

The reverse path **16** is defined by a lower surface **31** of a guide member **34** and an upper surface **32** of a guide member **35** and an upper surface **33** of the flap **17**. The guide member **34** and the guide member **35** are disposed inside the main body frame **53**. The guide member **34** is opposed to the guide member **35** and the flap **17** with a predetermined interval left therebetween. The lower surface **31** and the upper surfaces **32**, **33** extend obliquely, with respect to the bottom plate **113**, from the downstream portion **36** toward the feed rollers **25**.

According to another embodiment of the invention, the reverse path **16** may extend differently as long as the reverse path **16** connects the downstream portion **36** to the upstream portion **37** such that the sheet is conveyed back to the upstream portion **37**.

The path switching unit **41** is disposed downstream of the recording unit **24** in the first conveying path **23**, and adjacent to a connecting portion between the discharging path **23**B and the reverse path **16**. The path switching unit **41** comprises first rollers **45** and second rollers **46** which pair up respectively, and auxiliary rollers **47** disposed in parallel with the second rollers **46**.

The roller pairs **45**, **46** nip the sheet conveyed from the discharge roller **62** and the spur **63**, and conveys the sheet further downstream along the discharging path **23**B or conveys the sheet along the reverse path **16**.

The second rollers **46** and the auxiliary rollers **47** are mounted to a frame **48**. The frame **48** extends in a widthwise direction of the multi-function device **10**, i.e., a direction perpendicular to the sheet plane of FIG. **3**. The frame **48** is bent into an L shape in vertical cross section to have necessary rigidity.

The second rollers **46** and the auxiliary rollers **47** are disposed at predetermined intervals in the widthwise direction of the multi-function device **10**, and are supported rotatably on a shaft **50** and a shaft **51**, respectively. The second rollers **46** and the auxiliary rollers **47** may have a spur shape, similar to the spur shape of the spur **63**. The auxiliary rollers **47** are disposed upstream, by a predetermined distance, of the second rollers **46** in the discharging path **23**B. The second rollers **46** are biased toward the first rollers **45** by an elastic member.

The first rollers **45** are driven by a motor (not shown) via a predetermined transmission mechanism. The first rollers **45** have a center shaft **52** that is supported by the main body frame **53** of the multi-function device **10**.

The second rollers **46** are placed on the first rollers **45**. A single, elongated, cylindrical roller may be used, instead of the first rollers **45**. The first rollers **45** are driven by the motor (not shown) to rotate forwardly or reversely. The sheet conveyed from the recording unit **24** along the discharging path **23**B is nipped by the first rollers **45** and the second rollers **46**.

As shown in FIGS. **6** and **7**, the path switching unit **41** is configured such that the frame **48**, the second rollers **46**, and the auxiliary rollers **47** pivot, as a single body, about the center shaft **52** in a direction of arrow **29**. The path switching unit **41** changes its position toward the direction of arrow **29** depending on whether or not a driving force is transmitted thereto from the motor (not shown). More specifically, the path switching unit **41** changes between a discharging position and a reversing position. In the discharging position, as shown in FIG. **6**, the path switching unit **41** discharges the sheet having passed the recording unit **24** toward the discharge tray **21**. In the reversing position, as shown in FIG. **7**, the path switching unit **41** guides the sheet having passed the recording unit **24** in a reverse direction toward the reverse path **16**.

When the first rollers **45** rotate forwardly, e.g., clockwise in FIGS. **6** and **7**, the path switching unit **41** remains in the discharging position such that the sheet having passed the recording unit **24** is conveyed toward the discharge tray **21**, i.e., rightward in FIG. **6**. In a single-sided recording mode, the sheet fed by the feed rollers **25** is guided along the first conveying path **23** upward so as to make a U-turn toward the recording unit **24**, where an image is recorded on the first side (front side) of the sheet. Then, when the first rollers **45** rotate forwardly, the sheet discharged from the recording unit **24** is conveyed downward while being nipped by the first rollers **45** and the second rollers **46** and is discharged onto the discharge tray **21**.

In a double-sided recording mode, after the sheet discharged from the recording unit **24** reaches the path switching unit **41**, a trailing edge of the sheet is nipped by the first rollers **45** and the second rollers **46**. In this state, when the rotation direction of the motor is changed, the rotation direction of the first rollers **45** is changed from forward to reverse (counter-clockwise in FIGS. **6** and **7**), and the path switching unit **45** is changed from the discharging position to the reversing position. The auxiliary rollers **47** press the trailing edge of the sheet and direct the tailing edge toward the reverse path **16**. The first rollers **45** and the second rollers **46** convey the sheet

in the reverse direction with the trailing edge as a leading edge. Then, the feed roller **35** feeds the sheet to the first conveying path **23** again. After the recording unit **24** records an image on the second side (back side) of the sheet, the sheet is discharged onto the discharge tray **21**.

In this embodiment, the driving force of the motor (not shown) is transmitted to the feed rollers **25** via the pivot shaft **28** when the first rollers **45** rotate forwardly, and driving force is not transmitted to the feed rollers **25** when the first rollers **45** rotate reversely. In other words, the driving force is not transmitted to the pivot shaft **28** when the first rollers **45** convey the sheet along the reverse path **16**. This operation is done by controlling the motor for driving the feed rollers **25** independently of the motor for driving the first rollers **45**. In another embodiment of the invention, the above operation may be done by using a transmission switching member, e.g., a clutch and a planet gear, for a transmission system where the feed rollers **25**, the convey roller **62**, and the first rollers **45** are driven by a single common motor.

Either in the single-sided recording and the double-sided recording, a so-called reverse registration may be performed to correct skewing of the sheet before the sheet reaches the recording unit **24**. According to an embodiment of the invention, when the leading edge of the sheet fed to the curved path **23**A in the first direction **65** reaches the convey roller **60** and the pinch roller **61** and is pinched by these rollers **60**, **61**, the convey roller **60** is rotated reversely such that the sheet is conveyed, along the curved path **23**A, back to the feed tray **20** in a second direction **66** opposite to the first direction **65**. The leading edge of the sheet is pressed against the nip portion between the convey roller **60** and the pinch roller **61** by friction between the sheet being conveyed back along the curved path **23**A and the outer guide **18** and by repulsion of the sheet being bent. As a result, the leading edge is aligned with respect to the nip portion.

As shown in FIG. **3**, the flap **17** is disposed on the feed tray **20**. The flap **17** defines a part of the reverse path **16** and serves as a pressing member that contacts and presses downward the uppermost one of the sheets stacked in the feed tray **20**. The flap **17** comprises a flap body **121** and a pair of rollers **123**.

The flap body **121** extends obliquely with respect to the bottom plate **113** of the feed tray **20** such that a downstream end of the flap body **121** is below an upstream end of the flap body **121** in the first direction **65**. More specifically, the flap body **121** extends from an end of the discharge tray **21** toward the feed rollers **25**. The flap body **121** comprises a shaft **115** that is supported at the end of the discharge tray **21** such that the flap body **121** pivots about the shaft **115**.

The flap body **121** comprises a projecting portion **117**. The projecting portion **117** projects obliquely downward from a widthwise central portion of the flap body **121** toward a bottom plate **113** of the feed tray **20**. A widthwise center of the projecting portion **117** coincides with the reference position of the center-registered side guides **80**, **81**, i.e., the widthwise center of the feed tray **20**. An end portion **118** of the projecting portion **117** is positioned upstream of the feed rollers **25** in the first direction **65**, and is positioned in close proximity of the feed rollers **25**. The flap **113** is urged toward the bottom plate **113** of the feed tray **20** in a direction of arrow **119** (FIG. **3**) by a coil spring or the like provided on the shaft **115**.

As shown in FIG. **9**, the rollers **123** are attached adjacent to a downstream end of the end portion **118** in the first direction **65** and are arranged at intervals in the widthwise direction of the feed tray **20** which is perpendicular to the first direction **65**. The rollers **123** are positioned at the substantially widthwise center of the sheet feed tray **20**. The rollers **123** are positioned upstream of the feed rollers **25** in the first direction **65**, and are positioned in close proximity of the feed rollers **25**. The rollers **123** are supported rotatably by the projecting portion **117**. The rollers **123** may be made of a synthetic resin, e.g., a polyacetal (POM) resin.

Each of the rollers **123** is supported by the end portion **118** such that a roller surface of the roller **123** projects downward from a lower surface **125** of the projecting portion **117**. The lower surface **125** faces the bottom plate **113** of the feed tray **20** or an upper surface of the sheets stacked in the feed tray **20**. The rollers **123** contact the bottom plate **113** or the upper surface of the sheets in the feed tray **20**. A position where the rollers **123** contact the uppermost sheet in the feed tray **20** is upstream, in the first direction **65**, of a position where the feed rollers **25** contact the uppermost sheet. The flap **17** applies, via the rollers **123**, a downward pressing force to the sheets in the feed tray **20**, thereby to suppress floating and skewing of the sheet being fed from the feed tray **20**. Because the rollers **123** are rotated by the sheet being fed by the feed rollers **25**, a load applied by the flap **17** is reduced.

When the flap **17** presses the sheets, friction between two adjacent sheets increase. This may cause feeding of two or more sheets at the same time. To prevent such erroneous feeding, high-friction members **135**, e.g., cork plates, which have a higher friction coefficient than the bottom plate **113**, are placed on the bottom plate **113**. The high-friction members **135** are disposed at positions where the downward pressing force is applied by the rollers **123**. The pressing force increases friction between the sheets and the bottom plate **113**, and the increased friction retains the sheets on the bottom plate **113**. Even when the sheets receive the pressing force from the rollers **123**, erroneous sheet feeding is unlikely to occur. Especially, feeding of two or more sheets is prevented effectively when a small number of sheets remain in the feed tray **20**.

The roller surface of each of the rollers **123** does not project upward from an upper surface of the projecting portion **117**, i.e., the upper surface **33** of the flap **17** which defines a part of the reverse path **16**. Thus, the sheet guided along the reverse path **16** is conveyed smoothly toward the feed rollers **25** without being interfered by the rollers **123**.

The end portion **118** of the projecting portion **117** comprises a pair of first guides, e.g., a pair of guide surfaces **127**, each extending from a lower surface **125** of the projecting portion **117** to the upper surface **33** of the flap **17**. As shown in FIG. **8**, each of the guide surfaces **127** extends obliquely with respect to the bottom plate **113** or an upper surface of the sheets in the feed tray **20** when the roller **123** is in contact with the upper surface of the sheets. The guide surface **127** extends between a downstream end of the projecting portion **117** and a corresponding one of the rollers **123** such that a distance between the bottom plate **113** and the guide surface **127** increases along the first direction **65**. Thus, a space **129** tapered along the second direction **66** is created between the guide surface **127** and the bottom plate **113** or the upper surface of the sheets in the feed tray **20**.

As shown in FIG. **9**, the end portion **118** further comprises a pair of second guides, e.g., a pair of oblique guides **133**. Each oblique guide **133** extends between a corresponding one of the guide surfaces **127** and a corresponding one of side edges **131** of the projecting portion **117**. Each oblique guide **133** is positioned outside the corresponding guide surface **127** in the widthwise direction of the feed tray **20** and comprises a central portion and an outside portion which is positioned beyond the central portion in the feed tray widthwise direction. The oblique guide **133** extends such that the outside portion is more recessed than the central portion in the second direction **66**. As shown in FIGS. **10**A and **10**B, the oblique

guide **133** extends such that a distance between the bottom plate **113** and the oblique guide **133** increases from the central portion to the outside portion. As best shown in FIG. **10**B, the oblique guide **133** comprises a convex surface which faces the bottom plate **113**. By way of example, a distance between the bottom plate **113** and a central side end of the oblique guide **133** may be 0.8 mm, and a distance between the bottom plate **113** and an outside end the oblique guide **133** may be 1.65 mm.

FIGS. **10**A-**10**C illustrate reverse conveyance of a sheet in the above-described printer **11**, performed for the purpose of sheet registration or other reasons. As shown in FIG. **10**A, a sheet is fed by the feed rollers **25** in the first direction **1** to the curved path **23**A of the first conveying path **23** and reaches the convey roller **60** and the pinch roller **61**. A leading edge of the sheet is nipped between the convey roller **60** and the pinch roller **61**. At this time, a trailing edge of the sheet may be released from the rollers **123** if the sheet is A6, 4×6 inches in size or the like that are smaller than a predetermined size, e.g., A4.

Then, as shown in FIG. **10**B, the convey roller **60** is rotated reversely, and the sheet is conveyed, along the curved path **23**A, back to the feed tray **20** in the second direction **66** opposite to the first direction **65**. When the convey roller **60** is rotated reversely, the feed rollers **25** may be disconnected from the driving force and may be rotatable by the sheet conveyed in the second direction **66**. The trailing edge released from the rollers **123**, which is the leading edge with respect to the second direction **66**, abuts the guide surfaces **127** and is guided along the guide surfaces **127** toward the rollers **123**. Then, as shown in FIG. **10**C, the trailing edge guided along the guide surfaces **127** abuts the rollers and enters a lower side of the flap **17** while rotating the rollers **123**.

Even when the sheet is curled up at widthwise side edges, the feed rollers **25** press down the trailing edge of the sheet (leading edge of the sheet with respect to the second direction **66**) and suppress the curl such that the trailing edge is guided along the guide surfaces **127**. Further, the oblique guides **133** press down the curled portions of the trailing edge, other than the portions guided by the guide surfaces **127**, and guide the curled portions smoothly to a lower side of the flap **17**. Accordingly, when the sheet is conveyed back to the feed tray **20**, a collision between the trailing edge and the flap **17** is unlikely to occur. This minimizes skewing or jamming of the sheet, or damage to the sheet due to an interruption of the reverse conveyance of the sheet.

According to the above-described embodiment of the invention, the rollers **123** are disposed at the end portion **118**. Because rolling friction is less than sliding friction, load applied by the rollers **123** to the sheet conveyed under the rollers **123** are less than the case without the rollers **123**. Thus, the rollers **123** facilitate the sheet conveyed back to the feed tray **20** to enter the lower side of the flap **17**. However, the rollers **123** may be omitted, and the end portion **118** may be configured such that a lower surface thereof directly contacts the sheet.

According to another embodiment of the invention, the printer **11** may not have a both-sided recording mode and may have a single-sided recording mode only.

In a single-sided printer, the path switching unit **41** may be omitted, and the flap **71** is not required to define the reverse path **16**. The flap **17** serving as a sheet pressing member may be configured to extend from an end of the discharge tray **21** toward the feed tray **20** vertically, instead of obliquely. In this case, the flap **71** may be configured such that a contact position of the flap **17** with the upper surface of the sheets varies depending on the number of remaining sheets in the feed tray **20**. Alternatively, the flap **17** may be configured to extend from an end of the discharge tray **21** horizontally, parallel to the bottom plate **113** of the feed tray **20**. In either case, by implementing the guide surfaces **127** and the oblique guides **133** at the extending end of the flap **17** according to the above-described embodiment, a sheet conveyed in the reverse direction toward the feed tray **20** may be guided smoothly to the lower side of the flap **17**.

While the invention has been described in connection with embodiments of the invention, it will be understood by those skilled in the art that variations and modifications of the embodiments described above may be made without departing from the scope of the invention. Other embodiments will be apparent to those skilled in the art from a consideration of the specification or practice of the invention disclosed herein. It is intended that the specification and the described examples are considered merely as exemplary of the invention, with the true scope of the invention being defined by the following claims.

What is claimed is:

1. An image recording apparatus comprising:

a sheet conveying device comprising:

a feed tray comprising a bottom plate configured to hold a sheet;

a feed roller configured to feed the sheet in a first direction from the feed tray to a first conveying path; and

a pressing member configured to press the sheet in the feed tray against the bottom plate of the feed tray, the pressing member comprising:

a contact portion configured to contact the sheet in the feed tray; and

a first guide positioned at a downstream end of the pressing member in the first direction and extending obliquely with respect to the bottom plate between the downstream end and the contact portion, such that a distance between the bottom plate and the first guide increases along the first direction,

wherein the first guide is positioned upstream of the feed roller in the first direction; and

a recording unit disposed along the first conveying path and configured to record an image onto the sheet being conveyed along the first conveying path,

wherein the sheet conveying device is configured to convey the sheet along a second conveying path back to the feed tray after the sheet passes the recording unit,

wherein the pressing member further comprises a guiding surface that defines a part of the second conveying path and is configured to guide the sheet back to the feed tray, and

wherein the contact portion and the first guide of the pressing member face the bottom plate of the feed tray, and the guiding surface of the pressing member faces away from the bottom plate.

2. The image recording apparatus according to claim **1**, wherein the pressing member further comprises a second guide positioned outside the first guide in a feed tray widthwise direction, the feed tray widthwise direction is perpendicular to the first direction, the second guide comprises a central portion and an outside portion, the outside portion is positioned beyond the central portion in the feed tray widthwise direction, and the second guide extends, such that a distance between the bottom plate and the second guide increases from the central portion to the outside portion.

3. The image recording apparatus according to claim **2**, wherein the second guide comprises a convex surface which faces the bottom plate.

4. The image recording apparatus according to claim 1, wherein the pressing member further comprises a second guide positioned outside the first guide in a feed tray widthwise direction, the feed tray widthwise direction is perpendicular to the first direction, the second guide comprises a central portion and an outside portion, the outside portion is positioned beyond the central portion in the feed tray widthwise direction, and the second guide extends, such that the outside portion is more recessed than the central portion in a second direction opposite to the first direction.

5. The image recording apparatus according to claim 4, wherein the second guide comprises a convex surface which faces the bottom plate.

6. The image recording apparatus according to claim 1, further comprising a convey roller configured to convey the sheet, along the first conveying path, back to the feed tray in a second direction opposite to the first direction, wherein the first guide is configured to guide the sheet conveyed in the second direction to the contact portion.

7. The image recording apparatus according to claim 1, wherein the pressing member extends obliquely with respect to the bottom plate of the feed tray, such that the downstream end of the pressing member is below an upstream end of the pressing member in the first direction.

8. The image recording apparatus according to claim 1, wherein the contact portion of the pressing member comprises a rotary body that is rotatably supported at the downstream end of the pressing member.

9. The image recording apparatus according to claim 1, wherein a first position where the contact portion is configured to contact the sheet in the feed tray is upstream, in the first direction, of a second position where the feed roller is configured to contact the sheet in the feed tray.

10. The image recording apparatus according to claim 9, wherein the feed roller and the contact portion are positioned at substantially a center of the feed tray in a feed tray widthwise direction, and the feed tray widthwise direction is perpendicular to the first direction.

11. The image recording apparatus according to claim 1, further comprising a cover configured to partially cover an upper opening of the feed tray, wherein the pressing member is supported pivotably at an end of the cover.

12. The image recording apparatus according to claim 1, further comprising:

a discharge tray disposed along the first conveying path and configured to receive the sheet after the sheet passes the recording unit, and

a path switching unit disposed between the recording unit and the discharge tray along the first conveying path and configured to selectively direct the sheet to one of the discharge tray and the feed tray along one of the first conveying path and the second conveying path, respectively,

wherein the pressing member is configured to pivot about an end of the discharge tray.

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